includes a detection device shown generally at 51. The first section containing the gas mixing and ionizing chamber 49 is attached to the outlet end of pipe 29 for receiving the incoming gas sample to be tested. The gas mixing and ionizing chamber is defined by an open ended cylinder 53 which has affixed thereto a radiation source in the form of discrete radiation emitting elements 55. The upstream end of the cylinder is separated from the pipe 29 by means of an end wall 57 having an inlet nozzle 59 formed therewith to impart a turbulent flow to the incoming gas sample as it enters the chamber 49.

The detector section 43 includes a cylindrical collector electrode 61 having apertures 63 at one end thereof to admit ionized gas. Voltage is applied to a central electrode 65 from a suitable voltage source 67 to produce a gradient which will cause the gas ions to move toward the collector electrode 61, and produce a current which is measured by an electrometer amplifier 37. The gas flows through an outlet 71 and then to pipe 31 whereupon it is either routed back into the dynamoelectric machine or sent to a suitable vent. A wall 73 separates the gas mixing and ionizing chamber 49 from the detector section 43 except for the collector electrode 61. Reference again is made to U.S. Patent 3,573,460 to Skala for a general description of an ion chamber detector not including the improved construction of the present invention.

The ion chamber detector is improved by the present invention to great advantage for operation with a large gas cooled dynamoelectric machine by providing a heating means in combination with the ion chamber detector. The heating means is applied to the first section housing the gas mixing and ionizing chamber for the purpose of heating the ionizing gas to a temperature which will gasify more volatile non-pyrolysate particulates such as oil mist particles. The heating means may take the form of a band heater 81 which is applied to the outside circumference of the first section 41. Such a band heater is available from the Ogden Company under the designation HB455L50X (120V 890W). Heat control of the band heater is achieved by a thermostat 85 which may include a surface temperature feedback to the thermostat along line 87 from a thermocouple 88.

Heating the gas mixing and ionizing section is better than heating the incoming gas sample upstream from the ion chamber detector as, for example, by applying a band heater around pipe 29. This construction is less preferred since the gasified non-pyrolysate particulates may be condensed as they reach the ion chamber detector if it is at ambient temperature. It would also be possible to provide a heat source within the ion chamber detector, but this is deemed to be less attractive in terms of simplicity of construction of the present invention.

In discussing the background of the invention, it was stated that according to U.S. Patent 3,427,880 to Grobel et al certain portions of a gas cooled dynamoelectric machine may be coated with selected polymeric compositions which will decompose at elevated temperatures to produce decomposition products called pyrolysates. The detected decomposition of these selected polymers will give advance warning of localized overheating within the dynamoelectric machine. Coating polymers are selected on the basis of machine operating conditions. If it is desired that a relatively high temperature be allowed before an indication is given, it may be preferable to utilize the normal coating applied to the laminations, for example, the phenolformaldehyde polymer. This polymer will commence to give off decomposition particles in the neighborhood of 250°C in a pressurized hydrogen atmosphere. Actually, such continued decomposition of the normal lamination coating would lead to damage of the type which it is desired to prevent. Therefore, if preferred, special polymeric materials decomposing at lower temperatures than those which would damage the insulation or other parts of interest may be applied over the previously mentioned coating. These can be applied in areas of particular concern such as the tips of the stator teeth or inside the slot walls or on the duct spaces. The latter would give an indication of localized high temperature in the cooling ducts or around the stator teeth. Such coating materials employed to give advance warning of potential local damaging temperatures may comprise polyalphamethylstyrene, polystyrene, polymethyl methacrylate or cellulose propionate. These decompose and give off submicron decomposition particles rather abruptly as temperatures in the range of 165 – 190°C are reached in pressurized hydrogen. Other materials emitting decomposition particles at even lower temperatures are feasible. However, the pyrolysate particles that are produced are not gasified to a significant extent in the operating temperatures of the heated ion chamber.

On the other hand, a typical hydrogen seal oil used in large gas cooled dynamoelectric machines will produce an oil mist at temperatures as low as 124°C. It is determined by experiment that a typical oil mist could be gasified at a temperature of about 150°C. Since the gas temperature in the ionization chamber of the present invention is raised to the range of 150°C to 250°C, the more volatile non-pyrolysate oil-mist

particles will be gasified prior to entering the detector section and there will be no false signal due to non-pyrolysate products. If the temperature is raised too high, some of the less volatile pyrolysate components could begin to gasify depending upon the selected polymeric material. Therefore, according to the objects of the present invention the more volatile non-pyrolysate materials will be gasified prior to entering the detector section whereas the less volatile pyrolysates from selected polymeric materials will be unaffected whereby only those selected pyrolysates will cause a signal on the ion chamber detector giving an accurate warning of machine overheating. It has further been found that in the preferred embodiment, the band heater can be controlled by feedback thermocouple 88 to maintain the temperature of the ionized gas in the temperature range of 150°C. These temperature ranges are selected on the basis of a typical gas cooled dynamoelectric machine using typical polymeric coatings and hydrogen seal oils.

It has also been found that prior art radiation sources such as thorium impregnated rayon mantles become fragile and brittle after being subjected to the elevated temperatures of the hot ion chamber detector. In the environment of a large dynamoelectric machine and over prolonged usage at elevated temperatures it is possible that the rayon mantle would deteriorate due to rough handling or vibrations. Accordingly, the present invention may employ a thermally stable radiation source such as radioactive thorium 232 in the form of pieces of thorium oxide ceramic distributed over a metal cylindrical surface. Referring to Figure 2, the thorium oxide ceramic may be in the form of discrete button-like elements 55 distributed over a wire mesh cylindrical screen wherein the buttons are applied to the screen by means of suitable fasteners 56. These thorium oxide ceramic elements are applied uniformly over the axial length of the gas mixing and ionizing chamber. The wire mesh screen may be stainless steel or alternatively a Nichrome® metal sheet may be employed. Another alternative radiation source can be in the form of a cylinder consisting of a thorium oxide-yttrium oxide ceramic.

WHAT WE CLAIM IS:—

1. An apparatus for use in detecting the presence of pyrolysates in a gaseous carrier, said gaseous carrier being a coolant gas sample from a gas cooled dynamoelectric machine wherein certain machine parts are coated with selected materials which will decompose at an elevated temperature to produce said pyrolysates indicative of localized overheating of dynamoelectric machine parts; said apparatus comprising an outer shell including a gas mixing and ionizing section and a detector section, said detector section being arrayed to receive an ionized gas sample from said gas mixing and ionizing section, said detector section including spaced electrodes having a voltage applied thereto and between which current flow occurs by means of the ionized gas to produce a variable signal the magnitude of which is proportional to the current flow; and further including

heater means applied to the gas mixing and ionizing section, said heater means providing a temperature range of from 150°C to 250°C within the gas mixing and ionizing section whereby oil mist particles from the dynamoelectric machine may be gasified without affecting pyrolysates in the gaseous carrier; and,

a radiation source within said gas mixing and ionizing section comprising a plurality of discrete radioactive ceramic elements supported in said gas mixing and ionizing section.

2. An apparatus according to claim 1, further comprising

a cylindrical wire mesh support element disposed within said outer shell in the gas mixing and ionizing section; and wherein said radiation source comprises

a plurality of discrete radioactive elements of thorium 232 oxide ceramic attached along the axial length of said support element.

3. An apparatus for use in detecting the presence of pyrolysates in a gaseous carrier, substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

J. A. BLEACH & CO.
Agent for the Applicants

Printed for Her Majesty's Stationery Office by MULTIPLEX techniques ltd., St. Mary Cray, Kent. 1980. Published at the Patent Office, 25 Southampton Buildings, London WC2 1AY, from which copies may be obtained.

1571963 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

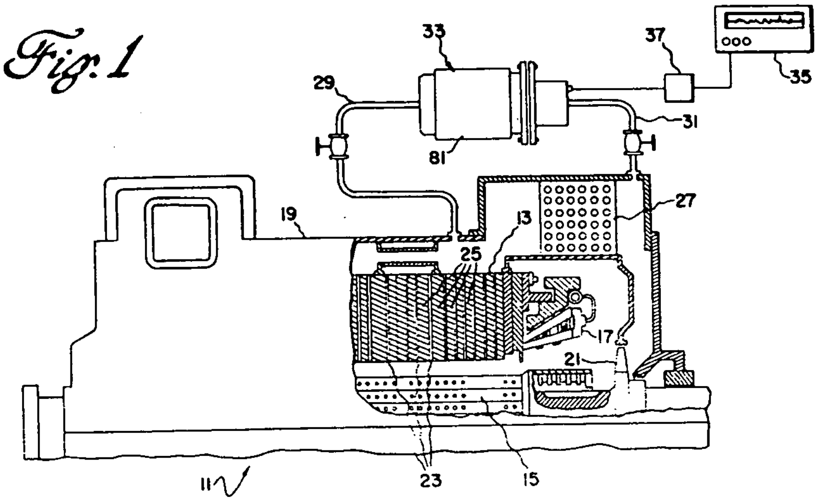

Fig. 1

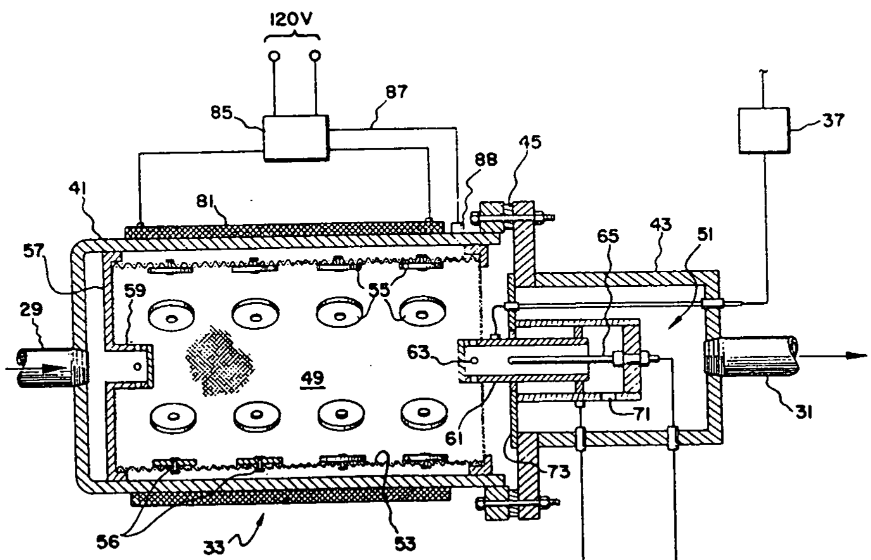

Fig. 2

THIS PAGE BLANK (USPTO)

A DOCPHOENIX

BACKFILE DOCUMENT INDEX SHEET

APPL PARTS

_____ IMIS _____
Internal Misc. Paper

_____ LET. _____
Misc. Incoming Letter

_____ 371P _____
PCT Papers in a 371Application

_____ A... _____
Amendment Including Elections

_____ ABST _____
Abstract

_____ ADS _____
Application Data Sheet

_____ AF/D _____
Affidavit or Exhibit Received

_____ APPENDIX _____
Appendix

_____ ARTIFACT _____
Artifact

_____ BIB _____
Bib Data Sheet

_____ CLM _____
Claim

_____ COMPUTER _____
Computer Program Listing

_____ CRFL _____
All CRF Papers for Backfile

_____ DIST _____
Terminal Disclaimer Filed

_____ DRW _____
Drawings

_____ FOR ✓ 26
Foreign Reference

_____ FRPR _____
Foreign Priority Papers

_____ IDS _____
IDS Including 1449

_____ NPL _____
Non-Patent Literature

_____ OATH _____
Oath or Declaration

_____ PET. _____
Petition

_____ RETMAIL _____
Mail Returned by USPS

_____ SEQLIST _____
Sequence Listing

_____ SPEC _____
Specification

_____ SPEC NO _____
Specification Not in English

_____ TRNA _____
Transmittal New Application

_____ CTNF _____
Count Non-Final

_____ CTRS _____
Count Restriction

_____ EXIN _____
Examiner Interview

_____ M903 _____
DO/EO Acceptance

_____ M905 _____
DO/EO Missing Requirement

_____ NFDR _____
Formal Drawing Required

_____ NOA _____
Notice of Allowance

_____ PETDEC _____
Petition Decision

OUTGOING

_____ CTMS _____
Misc. Office Action

_____ 1449 _____
Signed 1449

_____ 892 _____
892

_____ ABN _____
Abandonment

_____ APDEC _____
Board of Appeals Decision

_____ APEA _____
Examiner Answer

_____ CTAV _____
Count Advisory Action

_____ CTEQ _____
Count Ex parte Quayle

_____ CTFR _____
Count Final Rejection

INCOMING

_____ AP.B _____
Appeal Brief

_____ C.AD _____
Change of Address

_____ N/AP _____
Notice of Appeal

_____ PA.. _____
Change in Power of Attorney

_____ REM _____
Applicant Remarks in Amendment

_____ XT/ _____
Extension of Time filed separate

Internal

_____ SRNT _____
Examiner Search Notes

_____ CLMPTO _____
PTO Prepared Complete Claim Set

_____ ECBOX _____
Evidence Copy Box Identification

_____ WCLM _____
Claim Worksheet

_____ WFEE _____
Fee Worksheet

File Wrapper

_____ FWCLM _____
File Wrapper Claim

_____ IIFW _____
File Wrapper Issue Information

_____ SRFW _____
File Wrapper Search Info

REV 7/02/03